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Research Article

An Ecological Analysis of Forest Accounting

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Abstract

It is necessary to make theoretical analysis of various ecological aspects of forest accounting to make further improvement in it. World needs immediate action at theoretical and applied level as far as biodiversity is concerned. Forest accounting to certain extent help to mitigate same problem. The main objective of the study is to make ecological analysis of forest accounting in physical and monetary terms. The specific objectives of the study are as follows [1]. To study various ecological parameters of forest accounting [2]. To study significance of ecological features in forest accounting. Present study concludes that the ecological aspects of forests is vital for proper forest accounting system. And absence of forest accounting made impact on biodiversity and economy.

Keywords: Forest accounting; Forest valuation; Ecology; Biodiversity; Economics

An Ecological Analysis of Forest Accounting

Introduction

Forests maintain the ecological balance & life-support systems which is essential for food production, health as well as overall development of human kind. Forests services are invisible have been not accounted because of its resources values are neglected. It is leading big biodiversity loss that may cause to risk of disaster.

Statement of the problem

Global concern about forest degradation and depletion is related to two main problems i.e. destruction of the carbon sinks affecting the global climate and extinction of species affecting the biodiversity. Therefore, it needs immediate action at theoretical and applied level. Forest accounting to certain extent help to mitigate same problem. Forest accounting has various dimension and one of the important dimensions is its ecological classification. Forest accounting is complex phenomena involving invisible services of ecosystem and conversion of it in economic terms.

Review of literature

It has been examined earlier studies on forest accounting to explore various aspects of it. It supports to understand inter linkages between various factors while making theoretical analysis of ecological forest accounting. Haripriya et al. [3] they pointed out that to set out and apply a SEEA based methodology to show the true value of forest resources in India's national as well as state accounts. It is focused on four components of value creation in forest i.e. timber production, carbon storage, fuel wood usage and the harvesting of non-timber forest products. Harries M et al. [4] they critically examine the natural resource accounting in theory and practices. The prime aim of the study is an extensive review of the theoretical and applied literature on natural resource accounting. They also study the explaining of the economic theory that underpins natural resource accounting, counseling welfare and sustainability of the policy goals. In the study they present various concept of national income. Parikh [5] pointed out that the natural resource accounting for soil to estimate costs of soil degradation for India. Blignaut & Hassan [1] have studied natural resource accounting of mineral resources i.e. gold and coal in South Africa.

Objectives of the Study

The main objective of the study is to make ecological analysis of forest accounting in physical and monetary terms. The specific objectives of the study are as follows:

A. To study various ecological parameters of forest accounting.

B. To study significance of ecological features in forest accounting [6].

Preposition

Ecological features make impact on forests monetary value [7].

Research Methodology

The present research is case study of one of the forest rich district in India i.e. Kolhapur district forest. This district is situated in Western Ghats which is one of the mega biodiversity hubs in the world. Its theoretical analysis of various ecological components of

forest accounting. Present study is mainly depending of secondary sources of data [8].

Data Collection

Primary data

Present study is not based on primary data hence it does not require to collect it.

Secondary Data

Since present study is based on secondary sources of data it collects in various ways as follows:

A. Published Sources: The researcher collected the data from sources such as Directorate of Economics and Statistics (DES), Forest Department Government of Maharashtra, Administrative Report of Forest Department, Forest Survey of India, National Sample Survey of organization (NSSO), Central Statistical organization (CSO) and Books, research papers published in the Journals, Articles and different Websites etc.

B. Unpublished Sources: It includes unpublished research such as M. Phil dissertation, Ph.D. Thesis and reports.

C. Topical Scope of Study: Present research work is restricted only to forest accounting.

D. Analysis of the Study: Present research work made theoretical analysis of various ecological components of forest accounting [9].

Forest Accounting

It provides framework to capture to value of all economic contribution of forests and how they are linked to economy. There are certain parameters uses for the analyzing and keeping of forest resources accounting which are given below [10].

Actual/economic accounts

A. Physical Account

B. Monetary Account

C. Flow Account

Financial performance (income and expenditure) and ecological classifications

A. Legal Classification of Forests

B. Forest Types Wise

C. Species Wise

D. Animal/Fauna Wise

E. Forest Product Wise.

Valuation methods

A. Historical Cost Method

B. Market Price Method

C. Net Present Value Method

D. Discounted Cash Flow Method

E. Scholastic Discounted Cash Flow Method

F. Real Option Pricing Methods

G. Sensitivity Analysis

These parameters would help to make forest accounting to great extent in comprehensive manner. Apart from such parameters there are other parameters also that needs to be consider care such non-financial parameter. It is really challenging to make forest accounting since yet there is not comprehensive scientific forest accounting system have not been developed. Forest accounting is interdisciplinary field involving various discipline such as economics, finance, sociology, life sciences, mathematics, statistics, and physiology [11]. Therefore, this subject brings various challenges for researchers and policy makers at various stages.

Ecological Analysis of Forest Accounting

The value of forest is depending on its ecological characteristics and therefore while making forest accounting ecological classification is significant. The Ecological land classification is a cartographical delineation or regionalization of distinct ecological areas, identified by their geology, topography, soils, vegetation, climate conditions, living species, habitats, water resources, and sometimes also anthropic factors. However, Forest Ecology is the scientific study of the interrelated patterns, processes, flora. Fauna and ecosystems in forests. The management of forests is known as forestry, silviculture, and forest management. A forest ecosystem is a natural woodland unit consisting of all plants, animals and micro-organisms (Biotic components) in that area functioning together with all the non-living physical (abiotic) factors of the environment. The forest ecosystem is very important. Following is the forests ecological classification of Kolhapur district [12].

Trees

It has been in existence for 370 million years. In botany, a tree is a perennial plant with an elongated stem, or trunk, supporting branches and leaves in most species. In some usages, the definition of a tree may be narrower, including only woody plants with secondary growth, plants that are usable as lumber or plants above a specified height. Trees are not a taxonomic group but include a variety of plant species that have independently evolved a woody trunk and branches to tower above other plants to compete for sunlight. In looser senses, the taller palms, the tree ferns, bananas and bamboos are also trees. Trees tend to be long-lived, some reaching several thousand years old [13-16].

Source: Forest Department of Kolhapur District. The Table 1 shows that the Kolhapur district is reach by diversified trees at large number. There are various kind of trees are available in forests of Kolhapur district. It increases prospects of forests. Therefore, it is important to protect them. Species of trees are influence forest monetary value that become basis for forest accounting [17-20].

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Table 1: Trees in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Ain/Sadada	*Terminalia tomentosa*
2.	Alu	*Vangueria spinosa*
3.	Amba	*Mangifera indica*
4.	Ambada	*Spondias mangifera*
5.	Amberi	*Nothopegia colebrookiana*
6.	Ambat	*Embelia basaal*
7.	Anjani	*edule*
8.	Apta	*Bauhinia racemosa*
9.	Asana, Katak	*Bridelia retusa*
10.	Awala/Aonla	*Emblica officinalis*
11.	Arjun	*Terminalia arjuna*
12.	Akash neem	*Millingtonia hortensis*
13.	Bartondi	*Morinda tinctoria*
14.	Bakul	*Mimusops elengi*
15.	Bel	*Aegle marmelos*
16.	Bhendi	*Thespesia populnea*
17.	Bherli Mad	*Caryota urens*
18.	Bhokar	*Cordia myxa*
19.	Bhoma	*Glochidion lanceolarium*
20.	Bibla/Bija	*Petrocarpus marsupium*
21.	Biba/Bilva	*Semecarpus anacardium*
22.	Bibi/Ran/biba	*Holigarna grahamii*
23.	Bor	*Zizyphus jujube*
24.	Bulgi	*Vitex altissima*
25.	Babhul	*Acacia Arabica*

Shrubs: A shrub is an important component of forests. It is a small to medium-sized woody plant. It is distinguished from a tree by its multiple stems and short height. Plants of many species may grow either into shrubs or trees, depending on their growing conditions [21].

Source: Forest Department of Kolhapur District. The Table 2 shows that there are various species of shrubs are available in Kolhapur district forest. It is providing very valuable input to society. These all shrubs have its contribution in forest economy. There is need to take that monetary contribution in forest accounting of district [22].

Table 2: Shrubs in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Adulsa	*Adhatoda vasica*
2.	Ankul/Ankol	*Strobilanthes heyneanus*
3.	Bedki/Gudmari	*Alangium salvifolium*
4.	Bhamani	*Gymnema sylvestre*
5.	Bhandira	*Colebrookea oppositifolia*
6.	Bhandira	*Clerodendrum infortunatum*
7.	Bharati/Hekal	*Gymnosporia Montana*
8.	Bohkada /Charbati/ Kirmira	*Casearia graveolens*
9.	Bugdi	*Ardisia humilis*
10.	Bukra	*Strobilanthes sessilis*
11.	Dinda/Motha Dinda	*Leea sambucina*
12.	Dhaiti/Dhayati	*Leea macrophylla*
13.	Hesur	*Woodfordia fruticosa*

Climbers: The climbing plant is vital in forest ecology. The Climbing plants are plants which climb up trees and other tall objects. Many of them are vines whose stems twine round trees and branches. There are quite several other methods of climbing [23].

Source: Forest Department of Kolhapur District. Table 3 shows that there are no of climbing plants available in Kolhapur district. Along with environmental there are commercial importance of such plants such as use in gardening and horticulture. It's a value addition in forest economics of district.

Table 3: Climbers in Kolhapur district.

S. No.	Local Name	Botanical Name
1.	Alei	*Dalbergia volubilis*
2.	Amgul	*Elaeagnus latifolia*
3.	Bhui Kohola/Vidari Kand	*Ipomaea digitata*
4.	Cane	*Calamus pseudotenuis*
5.	Chambuli	*Bauhinia vahlii*
6.	Chickni	*Bridelia stipularis*
7.	Chillari	*Caesalpinia mimosoides*
8.	Garambi/Gardal	*Entada scandens*
9.	Ghotvel/Chopchini	*Smilax zeylanica*
10.	Gunj	*Abrus precatorisus*
11.	Jungali miree	*Piper hookeri*
12.	Kajarvel	*Strychnos colubrina*
13.	Kanheri/Borati/Burgi	*Zizyphus oenoplia*
14.	Vilayati vakundi	*Cryptolepis grandiflous*
15.	Kali vel/Jungali Kajorne	*Vitis auriculata*
16.	Kavali	*Cryptolepis buchanarous*
17.	Khaj Kuhili	*Mucuna pruriens*

Bamboos

The Bamboos are the significant crop of agro forestry economy. It has notable economic and cultural significance in society being used for building material, as a food source, and as a versatile raw product. It has a higher specific compressive strength than wood, brick, or concrete and a specific tensile strength that rivals steel [24-26].

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Source: Forest Department of Kolhapur District. Table 4 indicates that there are total 4 kinds of Bamboos species available in forest of Kolhapur district. The Bamboos has important commercial uses such as culinary, medicine, constructions, weapons, food, textiles, and musical instruments etc. The commercial value of such inputs enriches the forest accounting at large extent.

Table 4: Bamboos in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Chiwa/Huda/Chiwan	*Oxytenanthera monostigma/ Pseudoxytenanthera ritcheyi*
2.	Kalak/Padai/Mandgay/Velu/Kanak	*Bambusa bambos*
3.	Konda/Managa/Chiwari/Mes	*Oxytenanthera stocksii/ Pseudoxytenanthera stocksii*
4.	Shi/Udha/Medar	*Dendrocalamus strictus*

Grasses

It means a low, green plant that grows naturally over a lot of the earth's surface having groups of very thin leaves that grow close together in large numbers (Oxford dictionary). It is a very common plant consisting of large number of thin, spiky, green leaves that cover the surface of the ground [27].

Source: Forest Department of Kolhapur District. Table 5 shows that there are total 24 different species of grass available in district. It is very helpful to mankind, agriculturally, economically and ecologically. It is important source of food for man and animals both. Thus, its contribution needs to measure in monetary value and include in forest accounting.

Table 5: Grasses in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Anjan	*Cenchrus ciliaris*
2.	Bhalekusal	*Andropogon tricticeus*
3.	Bhongrut	*Themeda quadrivalvis*
4.	Boru	*Sorghum halepense*
5.	Burghushi	*Eragrostis tenella*
6.	Chikra	*Eragrostis tremula*
7.	Chigan chara	*Panicum prostatum*
8.	Dongari gawat	*Crysopogon Montana*
9.	Gondal	*Andropogon pumils*
10.	Haryali/doob	*Cynodon dactylon*
11.	Kunda	*Ischoemum pilosum*
12.	Kusali	*Heteropogon contortus*
13.	Marvel	*Dichanthium annulatum*
14.	Natgras	*Cyprus rotundus*
15.	Nilgawat	*Panicum antidotale*
16.	Phuli/Kodmor	*Apluda varia*
17.	Phulera	*Themeda ciliate*
18.	Pandhari Kusal	*Aristida paniculata*
19.	Sheda	*Sehima nervosum*
20.	Pavana	*Sehima sulcatum*
21.	Rosha/Tokhadi	*Cymbopogon martinl*
22.	Shimpi	*Panicum isachne*
23.	Vala	*Andropogon muricatus*
24.	Wavashi	*Saccharum procerum*

Medical Plants

The medical plants have been identified and used through in human history. It's part of culture and tradition since centuries. Plants make many chemical compounds that are for biological functions including defense against insects, fungi and herbivorous mammals. The medical plants have huge commercial benefits, it generates business out of it. Kolhapur district has numerous medical plants in its forests as follows.

Abrus precatorius, Abutilon indicum, Acacia concinna, Achyranthes aspera var, aspera, Acorus calamus, Adansonia digitata, Aegle marmelos, Alangium salvifolium var, salvifolium, Alsaonia schloaris, Anacardium occidentale, Andrographis paniculata, Anogeissus latifolia, Artocarpus, heterophyllus, Asparagus racemosus var, javanica, Azadirachta indica, Bacopa monnieri, Balanites aegyptiaca, Baliospermum montanu, Biophytum sensitivum, Bixa Orellana, Boerhavia repens var diffusa, Bombax ceiba, Bombyx micranthus, Boswellia serrate, Bridelia retusa, Buchanania cochinchinensis, Butea monosperma, Caesalpinia bonduc, Calotropis gigantean, C. procera, Careya arborea, Cassia fistula, C, obtusifolia, C. tota, Catharanathus roseus, Celastrus paniculatus, Celosia argentea var, argentea, Centella asiatica, Colocasia esculenta, Convolvulus arveensis, Cordia dichotoma, C. gharaf, Costus speciosus, Crateva adansonii subsp, odora, Crossandra infudibuliformis, Cullen corylifolia, Cuminum cyminum, Curculigo orchioides, Cymbopogon citratus, Cynodon dacthylon, Cyperus rotundus, subsp. Rotundus, Dendrophthoe falcate var, falcate, Dillenia indiaca, Dioscorea alata, D. bulbifera, Dodonea angustifolia, Dolichandrone falcate, Eclipata prostrate, Elaaeagnus conferta, Embelia ribes, Emblica officinalis, Entada rheedei, Ficus amottiana, F. benghalensis, F. callosa, F. carica, F. racemosa, F. religiosa, Garcinia indiaca, Garuga pinnata, Gloriosa superba, Glossocardia bosvallea, Gmelina arborea, Gnidia glauca, Hedyotis herbacea, Helicteres isora, Heliotropium indicum, and others.

The identification and commercial valuation of medical plants provide the basis for forest accounting. The medical plants are major component of forest economy. Its increase the monetary value of entire forest. Infact, there are certain forests are kept only for medical plants. Therefore, collecting information of medical plants, analyzing it, interpreting it and recording it in monetary value is significant.

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Mammals

The mammals include the largest animals on the planet, the great whales as well as some of the most intelligent such as elephants, primates and cetaceans.

Source: Forest Department of Kolhapur District. Table 6 shows that there are various species of mammals are available in district. It has direct contribution in human society and economy. For instance, domestic mammals form a large part of the livestock raised for meat across the world. It is commonly used in agriculture and allied activities. Forests is crucial component for existence of such mammals. The economic contribution of such mammals has linkages with forests.

Table 6: Mammals in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Bonnet Macaque	*Macaca radiate*
2.	Common Langur	*Preshbytis entelhus*
3.	Tiger	*Panthera tigris*
4.	Panther	*Panthera pardus*
5.	Leopard cat	*Felis bengalensis*
6.	Jungal cat	*Felis chaus*
7.	Desert cat	*Felis libyca*
8.	Small Indian Civet	*Viverricula indica*
9.	Common Plam civet	*Paradoxurus hermaphroditus*
10.	Common mongoose	*Herpestes edwardsi*
11.	Striped Hyena	*Hyaena hyaena*
12.	Wolf	*Canis lupus*
13.	Jackal	*Canis aureus*
14.	Indian Fox	*Vulpes bengalensis*
15.	Indian Wild Dog	*Cuon alpinus*
16.	Sloth bear	*Melursus ursinus*
17.	Common Otter	*Lutra lutra*
18.	Moles	*Talpa micrura*
19.	Indian Tree Shrew	*Anathana ellioti*
20.	Slender Loris	*Loris tardigradus*
21.	Flying Fox	*Pteropus giganteus*
22.	Fulvous Fruit-Bat	*Rousettus leschenaulti*
23.	Short-Nosed Fruit Bat	*Cynopterus sphinx*
24.	Indian Pipistrelle	*Pipistellus coromandra*
25.	Painted Bat	*Krivoula picta*

Avifauna

The birds or the kinds of birds of a region, period or environment. In simple word birds of a specific region or period. Birds are essential element of ecology.

Source: Forest Department of Kolhapur District. Table 7 indicates that there are bird's species available in forest of Kolhapur district. Birds has providing very essential benefits to human being such as food, business, pollination, fertility, pest control, rodent control, communication, company, and games, etc. Therefore, economic contribution of birds is vital and existence of birds is depend on forests.

Table 7: Avifauna in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1.	Little Grebe	*Podiceps ruficollis*
2.	Little Cormorant	*Phalacrocoras niger*
3.	Dater	*Anhinga rufa*
4.	Grey Heron	*Ardea cinerea*
5.	Purple Heron	*Ardea purpurea*
6.	Pond Heron	*Ardea gravii*
7.	Cattle Egret	*Babulcus ibis*
8.	Large Egret	*Ardea alba*
9.	Smaller Egret	*Egretta intermedia*
10.	Little Egret	*Egretta garzetta*
11.	Night Heron	*Nycticoras nycticorax*
12.	Little Bittern	*Ixobrychus minutus*
13.	Yellow Bittern	*Ixobrychus sinensis*
14.	Painted Stock	*Mycteria leucocphala*
15.	Openbill Stork	*Anastomus oscitans*
16.	Whitenecked Stock	*Ciconia episcopus*
17.	Lesser Adjutant	*Leptptilos javanicus*

Crocodile

The Crocodiles (subfamily Crocodylinae) or true crocodiles are large aquatic reptiles that live throughout the tropics in Africa, Asia, the Americas and Australia.

Source: Forest Department of Kolhapur District. Table 8 shows that the crocodile is also found in forest of Kolhapur district. The Crocodiles play very important role in the river ecosystem to ensure that river. These invisible ecosystem services in monetary value needs to be taken into consideration.

Table 8: Crocodile in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Mugger	*Crocodylus palustris*

Herpetofauna

The reptiles and amphibians of a particular region, habitat, or geological period. The Table 9 talks about Herepetoauna of Kolhur district.

Source: Forest Department of Kolhapur District. Table 9 reveals that there are different species available in forest of Kolhapur district. It is essential component of ecology and food chain. They provide numerous invisible services to protection of ecology.

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Table 9: Herpetofauna in Kolhapur district.

Sr. no	Local Name	Botical Name
1	Barhminy Wrom Snake	*Ramphotyphlops braminus*
2	Beaked Wrom Snake	*Grypotyphlops acutus*
3	Large Scaled Shieldtail	*Uroppeltis macrolepis macrolepis*
4	Indian Rock Python	*Python molurus molurus*
5	Common Sand Boa	*Gongylophis conicus*
6	Red Sand Boa	*Eryx johnii*
7	Common Trinket Snake	*Coelusognath Helena Helena*
8	Montane Trinket Snake	*Coelusognath Helena monticollaris*
9	Indian Rat Snake	*Ptyas mucosa*
10	Banded Racer	*Argyrogena fasciolata*

Turtle

The Turtles are classified as amniotes, along with other reptiles, birds, and mammals. Like other amniotes, turtles breathe air and do not lay eggs underwater, although many species live in or around water.

Source: Forest Department of Kolhapur District. Table 10 shows that there are total 6 species of turtle available in Kolhapur district forest. Turtles play an important role in the ecology and well-being of coastal and open ocean environments. It is essential for healthy ecosystem. It has biological, cultural and economic significance.

Table 10: Turtle in Kolhapur district.

Sr.No.	Local Name	Botanical Name
1	Black Turtle	*Melanochelys trijuga*
2	Indian Mud Turtle	*Lissemys punctata*
3	Brahminy River Turtle	*Lissemys punctate punctata*
4	Indian Flap-shell Turtle	*Lissemys punctate granosa*
5	Peninsular Flap-Shell Turtle	*Lissemys punctate granosa*
6	Indian Soft-Shell Turtle	*Aspideretes ganeticus*

Gecko

The Geckos are lizards belonging to the infraorder Gekkota, found in warm climates throughout the world. Geckos are unique among lizards in their vocalizations. Table 11 shows that there are 4 species of Gecko available in Kolhapur district forest. Geckos are reptiles with unique and interesting features and play an important role in maintaining a balanced ecosystem.

Table 11: Gecko in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Northen House Gecko	*Hemidactulus flaviviridis*
2	Brook's Gecko	*Hemidactylus brookii*
3	Termite Hill Gecko	*Hemidactylus triedrus*
4	Rock Gecko	*Hemidactylus maculatus*

Agamids

The Agamidae is a family of over 300 species of iguanian lizards indigenous to Africa, Asia, Australia, and a few in Southern Europe. Many species are commonly called dragons or dragon lizards.

Source: Forest Department of Kolhapur District. Table 12 reveals that there are total 4 Agamids species found in Kolhapur forest. Agamids is important for ecosystem balance and its diversity.

Table 12: Agamids in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Common Garden Lizard	*Calotes versicolor*
2	Forest Calotes	*Calotes rouxi*
3	Southern Green Calotes	*Calotes calotes*
4	Fan-throated Lizard	*Sitana ponticeriana*

Chameleons

Chameleons or chamaeleons (family Chamaeleonidae) are a distinctive and highly specialized clade of old world lizards with 202 species described as of June 2015. These species come in a range of colors, and many species can change colors (Table 13).

Table 13: Chameleons in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Indian Chmeleon	*Chamaeleon zeylanicus*

Source: Forest Department of Kolhapur District. In Kolhapur forest chameleons is also found. Chameleons can vary their coloration and pattern through combinations of pink, blue, red, orange, green, black, brown, light blue, yellow, turquoise, and purple. It is important features of nature's diversity.

Skinks

Skinks are lizards belonging to the family Scincidae and the infraorder scincomorppha. With more than 1,500 described species. The Scincidae is one of the most diverse families of lizards.

Source: Forest Department of Kolhapur District. Table 14 shows that their skinks species also available in Kolhapur forest. Various species occur in ecosystems ranging from deserts and mountains to grasslands.

Table 14: Skinks in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Brahminy Skink	*Mabuya carinata*
2	Little Skink	*Mabuya macularia*
3	Snake Skink	*Lygosoma punctatus*

Monitor Lizard

Table 15: Monitor Lizard in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Common Indian Monitor	*Varanus bengalensis*

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Monitor lizard is the common name of several large lizard species, comprising the genus Varanus (Table 15).

Source: Forest Department of Kolhapur District. Monitor lizards is useful. It is used for a variety of medical purposes. The flesh is eaten for the relief of rheumatic pain, abdominal fat is used as a salve for skin infections, oil and fat are used to treat hemorrhoids or chronic pain, and the oil is used as an aphrodisiac lubricant.

Toads

It is a common name applied to certain frogs, especially of the family Bufonidae that are characterized by dry, leathery skin, short legs, and parotid glands (Table 16).

Table 16: Toads in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Common Indian Toad	*Bufo melanostictus*
2	Marbled Toad	*Bufo stomaticus*

Source: Forest Department of Kolhapur District. Toads are important to the ecology and to humans. Toads provide important values for ecosystems and for human beings ecologically, they are important in food chains. Toads also serve as indicators of environmental health.

Frogs

A frog is any member of a diverse and largely carnivorous group of short-bodied, tailless amphibians composing the order Anura.

Source: Forest Department of Kolhapur District. Table 17 shows that there are total 10 species of Frogs available in Kolhapur district. The frogs provide essential benefit to human being such as medical advances, food, filter drinking water etc.

Table 17: Frogs in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Bush Frog	*Philautus sp*
2	Common Tree Frog	*Polypedates maculatus*
3	Skittering Frog	*Rana cyanophlyctis*
4	Indian Pond Frog	*Rarisna hexadactylus*
5	Indian Bull Frog	*Rana tigerina*
6	Indian Cricket Frog	*Rana limnocharis*
7	Fungoid Frog	*Rana malabarica*
8	Bicoloured Frog	*Rana curtipes*
9	Golden Frog	*Rana aurantiaca*
10	Indian Burroowing Frog	*Rana breviceps*

Butterflies

The butterfly is one of the most emblematic totem animals symbolizing personal transformation. Table 18 talks about different butterfly's species in Kolhapur forest.

Source: Forest Department of Kolhapur District. Table 18 reveals that there are total 75 various species of butterflies available in Kolhapur forest. Butterflies are indicators of a healthy environment and healthy ecosystems. Butterflies are an important element of the food chain and are prey for birds, bats and other insectivorous animals.

Table 18: Butterflies in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Twany Coaster	*Acraea violae*
2	Blue Tiger	*Tirumal limniace exoticus*
3	Common Crow	*Eploea core core*
4	Dark Blue Tiger	*Tirumala septentrionis dravidarum*
5	Glassy Blue Tiger	*Parantica aglea aglea*
6	Malabar Tree Nymph	*Idea malabarica*
7	Plain Tiger	*Danaus chrisisppsu chrisisppsu*
8	Banded Angle	*Danaus genutia genutia*
9	Brown Awi	*Odontoptilum angulata angulata*
10	Common Banded Awl	*Badamia exclamationis*
11	Common Spotted Flat	*Hasora chromus chromus*
12	Dark Palm Dart	*Celaenorrhinuus leucocera*
13	Golden Angle	*Telicota ancila bambusae*
14	Indian Palm Bob	*Caprona ransoneetta potiphera*
15	Indian Skipper	*Suastus gremius gremisus*
16	Malabar Flat	*Spialia galba galba*
17	Banded Blue Pierrot	*Celaenorrhinus ambarreesa*
18	Bright Bauul Blue	*Discolampa ethion vavasanus*

Moths

Moths comprise a group of insects related to butterflies, belonging to the order lepidopeera. Most lepidopterans are moths; and there are thought to be approximately 160,000 species of moth, many of which are yet to be described. Most species of moth are nocturnal but there are also crepuscular and diurnal species. Table 19 belongs to Moths of Kolhapur forest.

Source: Forest Department of Kolhapur District. Table 19 shows that 19 Kolhapur forest has 6 various species of moths. It is major part of our biodiversity and play vital roles in the ecosystem, affecting many other types of wildlife.

Table 19: Moths in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Moon Moth	----------
2	Owlet Moth	----------
3	Bee Hawk Moth	----------
4	Monkey Moth	----------
5	Atlas Moth	----------
6	Tussar Silk Moth	----------

Insects

Insects are a class of invertebrates within the arthropodphylum that have a chitinous exoskeleton, a three-part body (head, thorax

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and abdomen), three pairs of jointed legs, compound eyes and one pair of antennae. Table 20 related to Insects in Kolhapur district.

Source: Forest Department of Kolhapur District. Table 20 shows that 13 species of insects are available in Kolhapur forest. Insects are very important as primary or secondary decomposers. Without insects to help break down and dispose of wastes, dead animals and plants would accumulate in our environment and it would be messy indeed. Insects are underappreciated for their role in the food web. Insects are important in nature to help keep pest populations (insects or weeds) at a tolerable level.

Table 20: Insects in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Sick Insect	*Vespa orientalis*
2	Hornet Wasp	*Teratodes monticollis*
3	Hooded Grass Hopper	----------
4	Painted Grass Hopper	--------
5	Praying Mantis	----------
6	Leaf Insects	----------
7	Tortoise Shelled Beetle	----------
8	Dragon Fly	----------
9	Damsel Fly	----------
10	Leopard Beetle	----------
11	Bombardial Bettle	----------
12	Long Horned Beetle	----------
13	Spittle Bug	----------

Arachnids

Arachnids are a class (Arachnida) of joint legged invertebrate animals (arthropods), in the subphylum Chelicerata. All arachnids have eight legs, although the front pair of legs in some species has converted to a sensory function, while in other species, different appendages can grow large enough to take on the appearance of extra pairs of legs. Table 21 belongs to Arachnids in Kolhapur district.

Table 21: Arachnids in Kolhapur district.

Sr. No.	Local Name	Botanical Name
1	Scorpion	----------
2	Harvestmen	----------
3	Ticks and Mites	----------
4	Whipscorpion	----------
5	Spiders	----------
6	Speckled Band Four leg	----------
7	Banded Four leg	----------
8	Giant Wood Spider	----------
9	Black Wood Spider	----------

Source: Forest Department of Kolhapur District. Table 21 reveals that there are total 20 kind of species of Arachnids are available in Kolhapur forest. The arachnids play an important role in limiting the size of other arthropod populations, especially insects. Some arachnids are pests, such as ticks and mites, but most are beneficial and should be protected.

Conclusion

In forests valuation ecological features of forest is significantly influence forests monetary value. Hence it is inevitable that to make detailed ecological classification of forests. Kolhapur district forest has tremendous ecological inputs that increase value of forests. There are 20 ecological characteristics of Kolhapur forests such as Trees, Mammals, Arachnids, Insects, Moths, Butterflies, Frogs, Toads, Lizard, Skinks, Avifauna, Crocodile, Shrubs, Grasses, Bamboos, Medical plants, Climber, Herpetofauna, Agamids, Gecko, Turtle, Chameleons and its various species. These ecological elements enrich Kolhapur forests value in greater extent. Ecological diversified forests have more monetary value because it provides diversification in output of forests. Therefore, in making of forest accounting analysis of ecological elements of forest is essential. Being hilly region Kolhapur forests has scope for agro forestry practices such as cashew cultivation and mango cultivation. Agro forestry practices largely increases the prospects of Kolhapur forests. Forest accounting is helping to identified biodiversity loss and to mitigate risk of disaster.

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